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ABSTRACT:

CHG DATE=19990617 STATUS=O> The telephone line tester includes housing 10 with a telephone jack plug 12 fixed to one end. A detection circuit within the housing 10 provides visual indications of reverse connection on LED 14a, normal connection on LED 14b and bell line on LED 14c, when the plug 12 is inserted into a telephone jack socket. Thus it is possible to check for correct connection of telephone wires to telephone jack sockets; this is particularly used during installation of extension points. <IMAGE>

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(54) Telephone line tester

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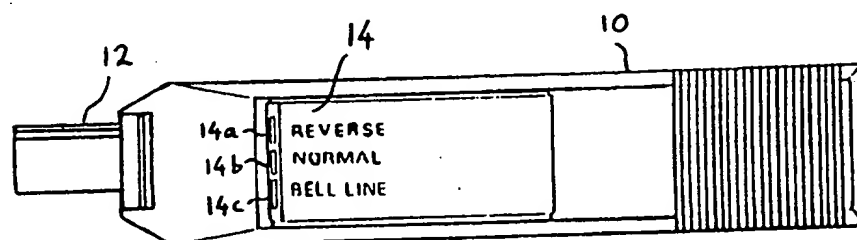


FIG. 1A

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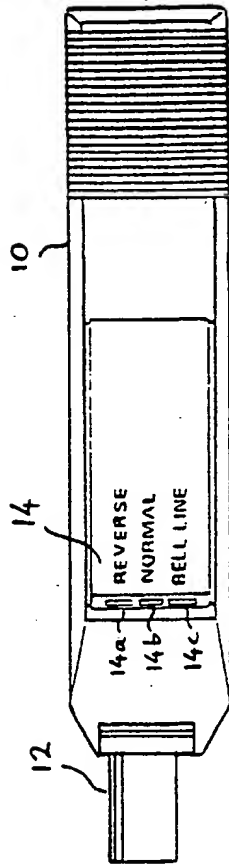


FIG. 1A

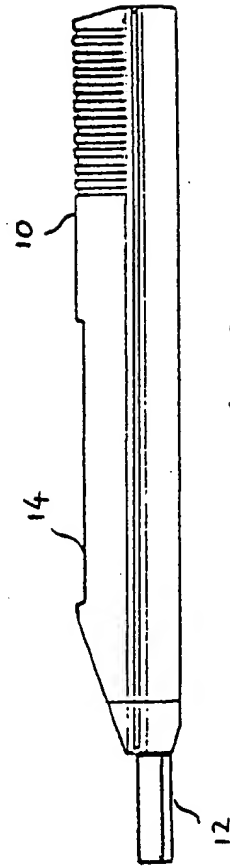


FIG. 1B

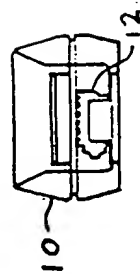


FIG. 1C

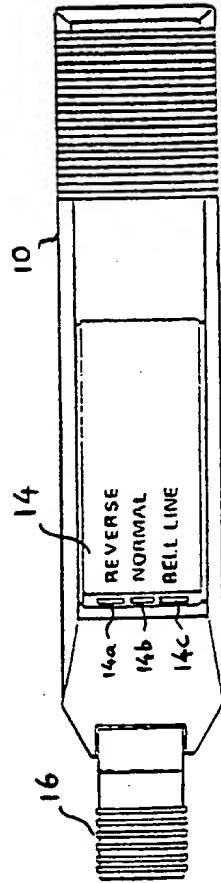


FIG. 2A

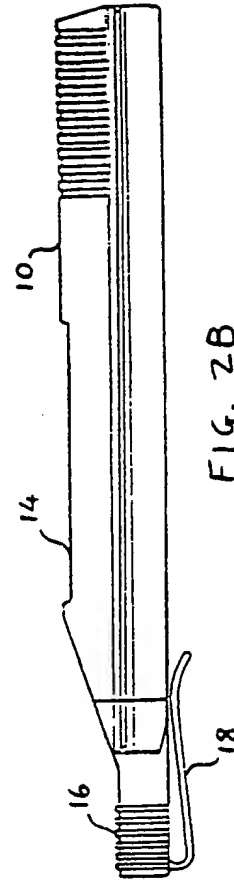


FIG. 2B

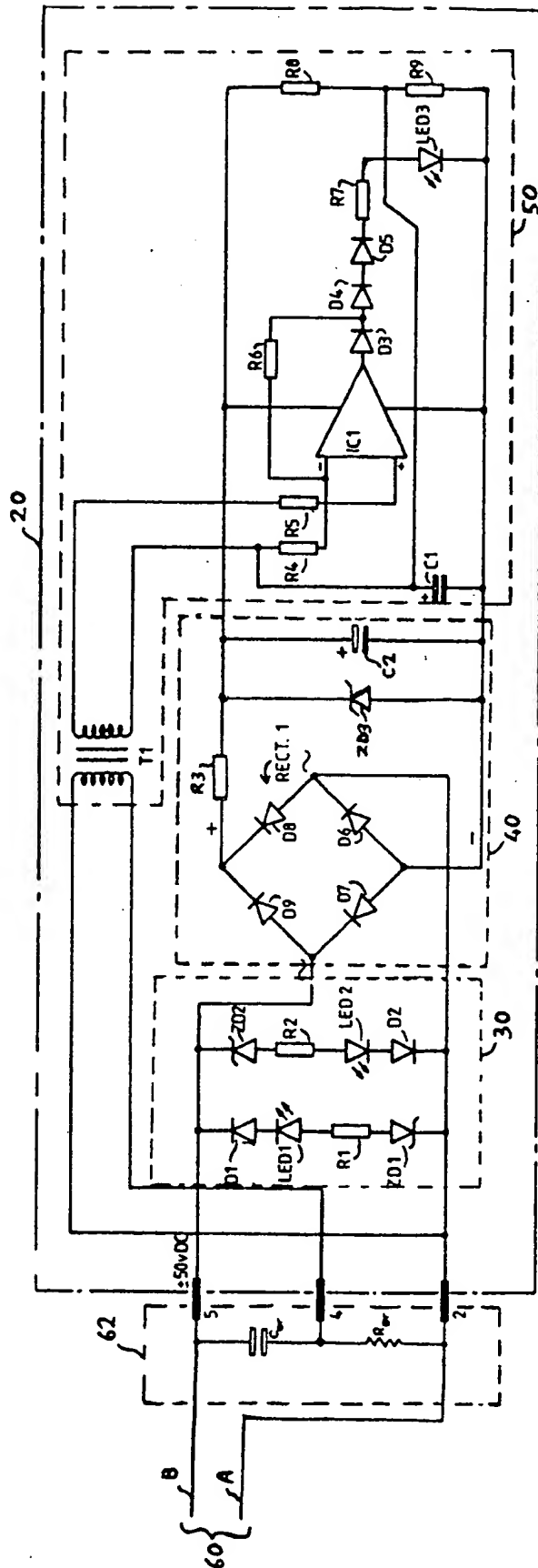


FIG. 3

TELEPHONE LINE TESTING APPARATUS

This invention relates to telephone line testing apparatus, and in particular to such apparatus which is suitable for checking for correct connection of extension points of a telephone line or the like.

Since the introduction in the United Kingdom of removable jack plugs and sockets for connecting telephones (and related equipment such as answering or facsimile machines or modems) to telephone lines, and also as a result of the liberalisation of restrictions on connection of such equipment, it is common for premises to be fitted with an increased number of telephone connection sockets. Particularly when these extra sockets are fitted as extension points to existing sockets, it is important to check that the wiring has been connected correctly and that therefore a telephone or related equipment will function properly when connected to one of these sockets. It is possible to check for correct connection by using standard general-purpose test equipment, but this is cumbersome, expensive and difficult to use; a person other than an expert may be unable to tell whether the connections are correct.

According to the present invention there is provided telephone line testing apparatus comprising first detecting means for detecting the voltage and polarity of a DC component present on a telephone line, and second detecting means for detecting the presence of an AC dial tone on the telephone line.

In a preferred embodiment of the invention, described in greater detail below, the detecting means provide visual indications of the conditions being tested, such as by the use of light emitting diodes (LEDs). One LED can be provided to show normal (correct) connection of the line voltage, with a second LED showing reverse connection of the line voltage. A third LED can show the presence of the dial tone on the ring line. The preferred testing apparatus is powered from the telephone line, deriving its power requirements from the telephone DC line voltage, and is hand-holdable with a telephone plug part extending from its housing which plug part is capable of being inserted directly into a corresponding telephone jack socket.

Thus the preferred testing apparatus is compact and readily portable, is easy to use even by non-experts, and can be made

relatively cheaply.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

5       Figure 1A shows a plan view of a telephone line tester embodying the present invention;

          Figure 1B shows a side view of the tester shown in Figure 1A;

          Figure 1C shows an end view of the tester shown in Figures 1A and 1B, seen from the plug part end;

10       Figure 2A is a view similar to that of Figure 1A but with a cover over the plug part;

          Figure 2B is a view similar to that of Figure 1B, again with the cover in place; and

15       Figure 3 is a circuit diagram of the detection part of the tester embodying the invention.

20       Referring first to Figures 1A to 1C, there is shown a housing 10 of a telephone line tester embodying the invention, the housing 10 being generally elongate and hand-holdable, with a telephone jack plug part 12 fixed to one end of the housing 10. Also included is an indicator display 14 which comprises three LEDs 14a, 14b, 14c respectively for "reverse", "normal" and "bell line" indications, to be described in fuller detail below.

25       As shown in Figures 2A and 2B, a cover 16 is provided to fit detachably over the plug part 12 when the tester is not in use. The cover 16 can conveniently include a pen-type clip 18 for carrying the tester in a pocket or similar.

30       Within the housing 10 is included a detection circuit 20, the preferred form of which is shown in the circuit diagram of Figure 3. Referring to Figure 3, the detection circuit 20 can be considered to be made up of three parts, a line voltage and polarity detecting circuit 30, a power supply 40 and a dial tone amplification and detection circuit 50.

35       A telephone line 60 is shown as including two conductors, and these are generally designated the 'A' and 'B' wires, as illustrated. In a standard British Telecom socket 62, a series combination of a capacitor  $C_{BT}$  and a resistor  $R_{BT}$  is connected between the 'A' and 'B' wires of the telephone line, and the junction between the capacitor

$C_{BT}$  and the resistor  $R_{BT}$  provides an output for the dial tone, the capacitor  $C_{BT}$  acting to block the DC line potential on the telephone line 60. Terminals 2, 4 and 5 of the socket 62 are respectively connected to the 'A' wire, the resistor/capacitor junction, and the 'B' wire.

The plug part 12 of the telephone tester also includes terminals 2, 4 and 5 for interconnecting with the like-numbered terminals of the socket 62. The terminals 2 and 5 are connected to the line voltage and polarity detecting circuit 30 and also to the power supply 40.

The line voltage and polarity detecting circuit 30 comprises two series-connected chains of components, the first chain consisting of a diode D1, a first light emitting diode LED 1, a resistor R1 and a zener diode ZD1. The second chain consists of a zener diode ZD2, a resistor R2, a second light emitting diode LED 2 and a diode D2, the polarity-dependent components of the second chain being connected in the opposite sense to those of the first chain. Assuming that the socket 62 has been wired correctly, the terminal 2 should be at about +50 V DC with respect to the terminal 5, and if this is the case, the LED 1 will be illuminated. The other components in the chain including the zener diode ZD1 ensure that illumination will only occur above a certain line voltage, typically 45 V DC. If the socket 62 has been reverse-wired, the terminal 5 will be at about +50 V DC with respect to the terminal 2. In these circumstances, the LED 2 will be illuminated, indicating reverse connection.

The power supply 40 is of standard configuration, including a bridge rectifier RECT 1 comprising four bridge-connected diodes D6 to D9, a series resistor R3, a zener diode ZD3 and a smoothing capacitor C2, the latter two components being connected across the output voltage terminals. The bridge rectifier RECT 1 is not used for rectifying AC, but for ensuring that a stable polarity voltage is produced for the dial tone amplification and detection circuit 50, irrespective of the polarity of the terminals 2 and 5.

The dial tone amplification and detection circuit 50 includes a transformer T1 having a primary winding connected to the terminals 2 and 4. The secondary winding of the transformer T1 is connected via resistors R4 and R5 to the inputs of an operational amplifier IC1. The output of the operational amplifier is connected via three diodes D3,



D4, D5 and a resistor R7 to a third light emitting diode LED 3. A feedback resistor R6 is connected between the output of the diode D3 and the inverting input of the operational amplifier IC1. The DC conditions of the operational amplifier IC1 are set by resistors R8, R9  
 5 connected across the power supply output, and by a capacitor C1.

When the tester is connected to a phone socket, it draws enough current from the ring line so as to receive a dial tone. The dial tone is received by the transformer T1 which isolates the dial tone from DC and feeds it to the operational amplifier IC1 in which the dial tone is  
 10 amplified from the received low level to a level which is sufficient for it to illuminate the LED 3 after rectification by the diodes D3 to D5.

Thus illumination of the LEDs 1, 2 and 3 respectively provide indications of normal connection, reverse connection and dial tone.  
 15 This is set out in the following table,

TABLE

|    | DIAL TONE | NORMAL | REVERSE |   |
|----|-----------|--------|---------|---|
| 20 | ON        | ON     | -       | LINE OK   |
|    | ON        | -      | ON      | LINE USABLE FOR<br>SOME APPLICATIONS<br>(SEE BELOW) |
|    | -         | ON     | -       | FAULTY LINE   |
| 25 | -         | -      | ON      | FAULTY LINE   |
|    | -         | -      | -       | FAULTY LINE   |

When the wires are reversed but a dial tone is present, the line is usable for certain applications such as for conventional telephones.  
 30 However, reverse connection of the wires may cause difficulties with certain types of developed apparatus, such as modems or answering machines.

The circuit shown in Figure 3 will operate over a frequency range of 33 to 360 Hz, and also at levels of 0 to -27dBm, thus covering  
 35 existing and new proposed dial tone frequencies, such as those set by BS6305 Sect. C2, Standard Supervisory Tones.

CLAIMS

1. Telephone line testing apparatus comprising first detecting means for detecting the voltage and polarity of a DC component present on a telephone line, and second detecting means for detecting the presence of an AC dial tone on the telephone line.
2. Apparatus according to claim 1, wherein the first and second detecting means include means for providing a visual indication of the condition being tested.
3. Apparatus according to claim 2, wherein the first and second detecting means comprise light emitting elements.
4. Apparatus according to claim 3, wherein the first and second detecting means comprise light emitting diodes.
5. Apparatus according to any one of the preceding claims, wherein the first detecting means comprises first and second rectifying means connected in opposite polarity parallel, wherein a current will flow in one of the first and second rectifying means depending on the polarity of the DC component.
6. Apparatus according to any one of the preceding claims, wherein the second detecting means comprises means for rectifying the AC dial tone.
7. Apparatus according to claim 6, wherein the second detecting means includes a transformer and an amplifier for amplifying the AC dial tone before rectification.
8. Apparatus according to any one of the preceding claims, including a power source means for providing a power source voltage from the DC component on the telephone line.
9. Apparatus according to claim 8, wherein the power source means comprises a rectifier arranged to provide a power source voltage of a

specific polarity irrespective of the polarity of the DC component on the telephone line.

10. Apparatus according to claim 9, wherein the rectifier is a bridge  
5 rectifier.

11. Apparatus according to claim 9 or claim 10, wherein the power source means includes smoothing and stabilising means.

10 12. Apparatus according to any one of the preceding claims, wherein the first and second detecting means are incorporated within a hand-holdable housing.

13. Apparatus according to any one of the preceding claims, including  
15 a telephone plug part engageable with a telephone socket to be tested.

14. Apparatus according to claim 13 as dependent on claim 12, wherein the telephone plug part is fixed to the housing.

20 15. Apparatus according to claim 14, wherein the housing is elongate and the telephone plug part is fixed to one end of the elongate housing.

16. Apparatus according to claim 15, including a cover which is  
25 attachable to the housing for covering the telephone plug part.

17. Telephone line testing apparatus substantially as hereinbefore described with reference to the accompanying drawings.